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(54) A heating device for a fan

(57) The present invention discloses a heating device for a fan which has a fan impeller (2) and a driving motor (5) connected to the fan impeller (2) through its driving shaft to drive the fan impeller (2), and comprises a length of heating element (1) thereon mounted on the fan and in the air delivery path of the fan, and adapted to be coupled to an electrical power source; and means (17; 17') for switching on the heating element (1) when the rotational speed of the fan impeller (2) exceeds a predetermined speed, and switching off the heating element (1) when the fan impeller (2) drops below the predetermined speed, the switching means (17; 17') secured on the fan impeller (2) for being rotated with the fan impeller (2).

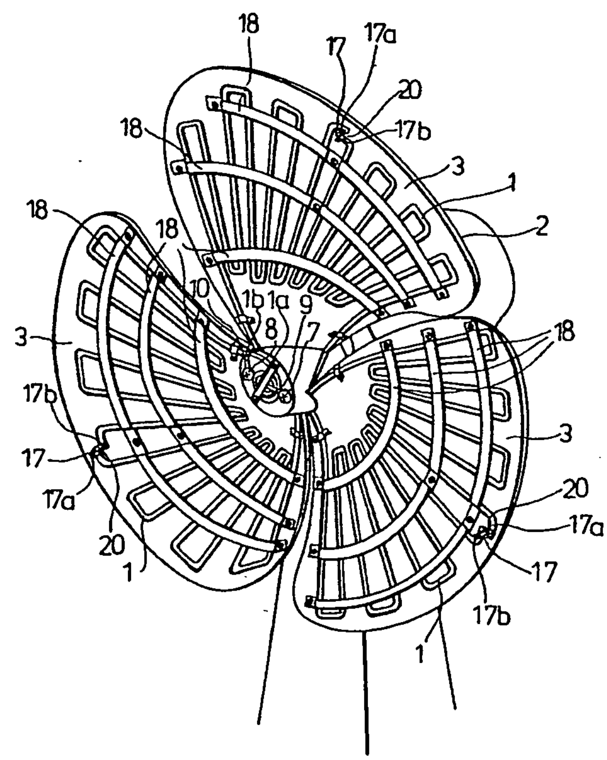

FIG. 1

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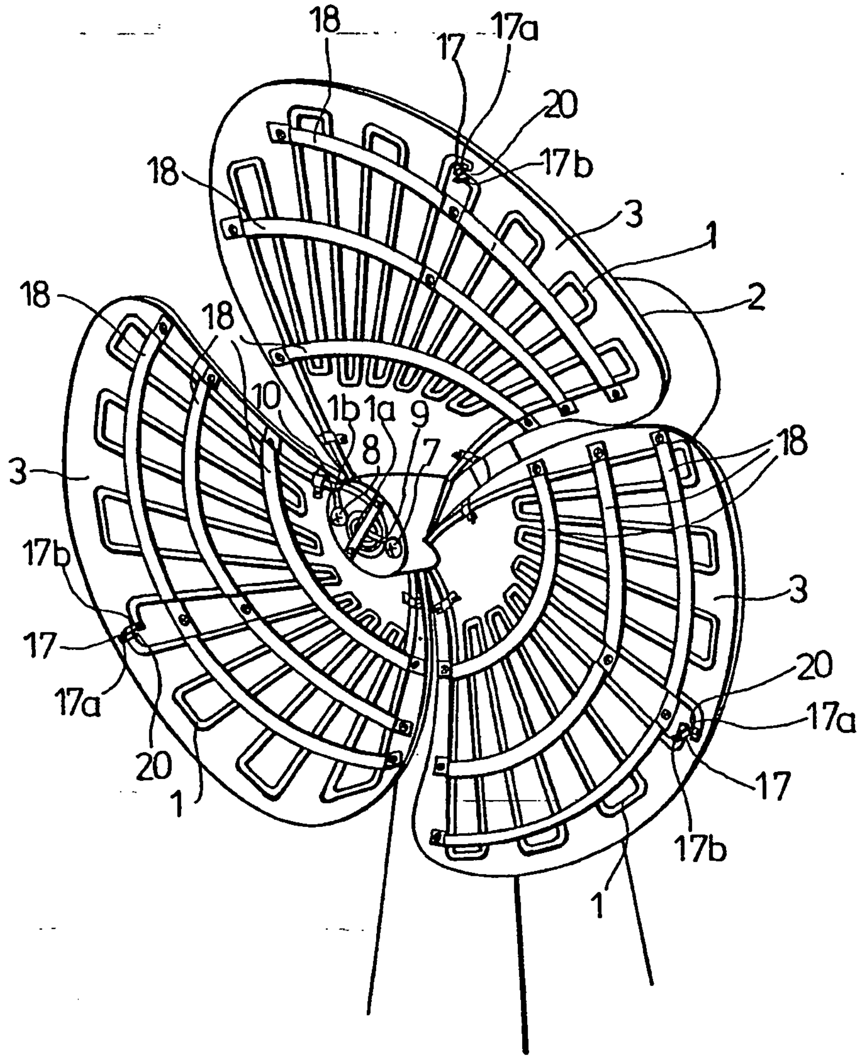

F I G. 1

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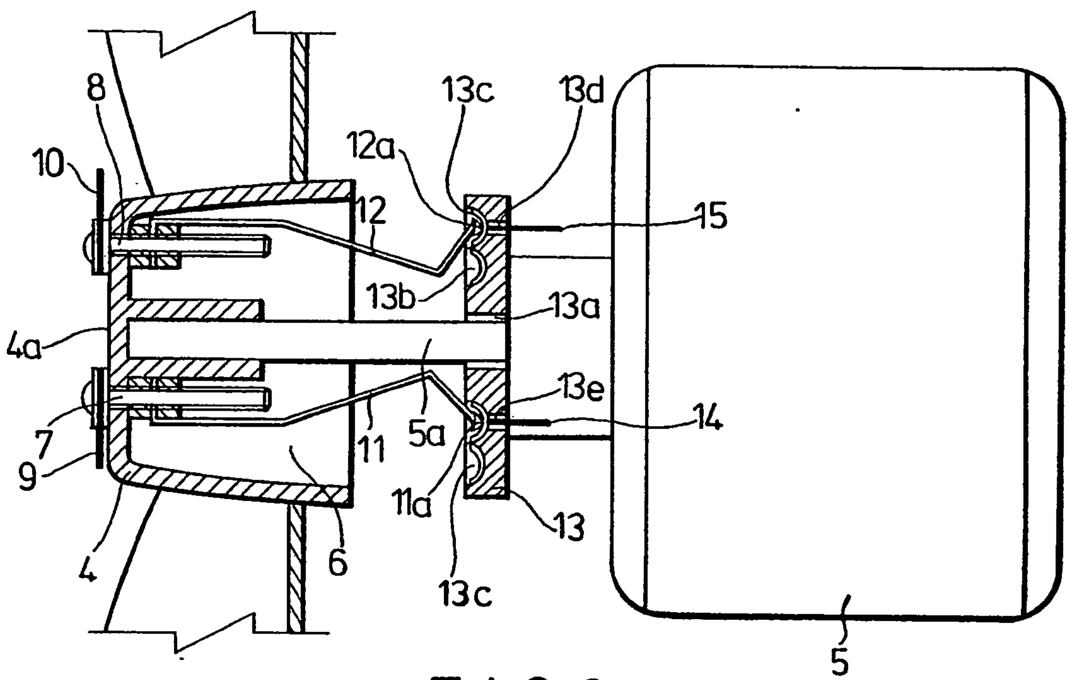
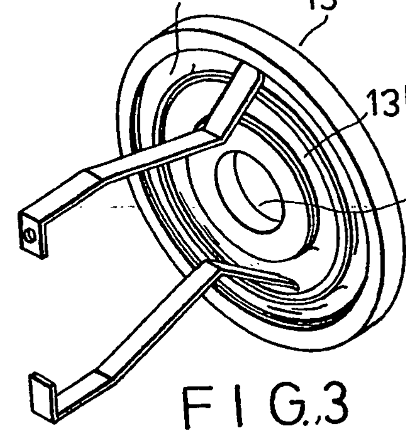


F I G 2



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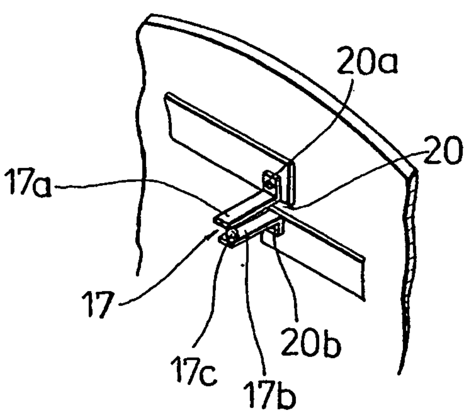

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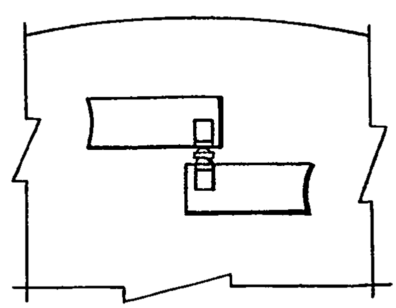

F I G. 5

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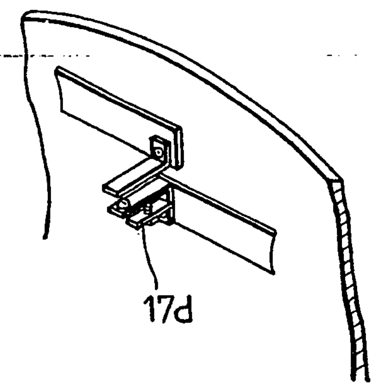
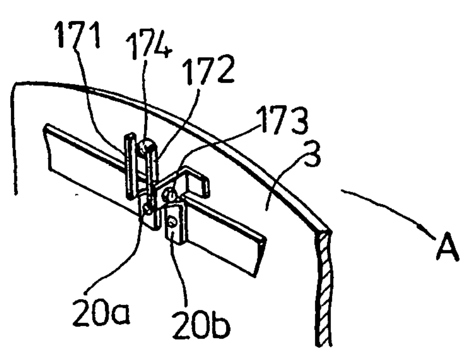


F I G. 6



F I G. 7

SPECIFICATION

A heating device for a fan

The present invention is related to a heating device for a fan, and more particularly to a heating device which can be switched on when the rotational speed of the fan impeller of the fan exceeds a predetermined speed, and shut off when the rotational speed of the fan impeller drops below a predetermined speed.

The conventional heating device used by the electric fan generally includes a fixed frame adapted to be mounted on the housing around the fan impeller, and a heating element wound on the fixed frame. The external surfaces of the fixed frame are covered by an electrical insulation material, such as mica, having heat-resistant characteristics. One type of the conventional electric fan has two individual switches for controlling the fan impeller and the heating device respectively, whereas the other type has only one switch for simultaneously controlling the fan impeller and the heating device. Apparently, the former is more advantageous than the latter. However, during the operation of the former, it is often the case that the switch for controlling the fan is opened and the switch for controlling the heating device is closed due to the user's carelessness. This will quickly raise the temperature in the fan, and may result in the melting of the fan impeller, which is generally made of plastic material.

For solving the above problems, a temperature controlling switch is utilized to automatically shut off the heating device when the temperature around the fan reaches a predetermined height. However, the predetermined temperature is usually preset at a relatively high value for preventing the temperature controlling switch from prematurely shutting off the heating device. In the event that the wrong operation occurs, e.g. the switch for controlling the fan impeller is opened while the switch for controlling the heating device is improperly closed, the electrical power will not be interrupted until the increasing temperature of the heating device reaches the predetermined temperature. Therefore, it is still inadvantageous that the heating device cannot be immediately turned off in response to the situation that the heating device is not needed.

A heating device in accordance with one preferred embodiment of the present invention intends to solve the problems described above.

The object of the present invention is to provide a heating device for a fan which utilizes means for switching on a heating element of the heating device when the rotational speed of the fan impeller exceeds a predetermined speed, and switching off the heating element when the fan impeller drops below the predetermined speed.

In accordance with the present invention, the heating device for a fan which has a fan impeller and a driving motor connected to the fan impeller through its driving shaft to drive the fan impeller, comprises a length of heating element having a breaking gap thereon mounted on the fan and situated in the air delivery path of the fan, and adapted to be coupled to an electrical power source; and means for switching on the heating element when the rotational speed of the fan impeller of the fan exceeds a predetermined speed, and switching off the heating element when the fan impeller drops below the predetermined speed, the switching means connected on the breaking gap and secured on the fan impeller for being rotated with the fan impeller.

The present invention will be more fully understood from the following detailed description, taken in connection with the accompanying drawings which form an integral part of this application and in which:

Fig. 1 is a perspective view illustrating that the heating device is mounted on the fan blades in accordance with one preferred embodiment of the present invention;

Fig. 2 is a side elevational view of a part of the fan with a cross-sectional portion illustrating the way by which the heating device is coupled to an electrical power source;

Fig. 3 is a perspective view of a stationary disc and two fastening means as shown in Fig. 2;

Fig. 4 is an enlarged perspective view of the switching means in accordance with the first embodiment of the present invention;

Fig. 5 is an elevational view of the switching means of Fig. 4;

Fig. 6 is a perspective view of the switching means of Fig. 4 incorporated with an adjusting means;

Fig. 7 is a perspective view of the switching means incorporated with an adjusting means in accordance with the second preferred embodiment of the present invention.

Referring now to the drawings, it should be noted that a like member is designated with a like reference number. In Fig. 1, there is shown a heating device provided in the fan impeller 2 of a fan by the way that a length of heating element 1 of the heating device is serpentined on the surfaces of the fan blades 3 of the fan impeller 2, and a plurality of securing members 18 are positioned on the heating element 1 and fastened to the fan blades 3 respectively for affixing the heating element 1 firmly on the fan blades 3. Two free ends 1a and 1b of the heating element 1 are respectively fixed on the fan impeller 2 by two fastening means 7 and 8, e.g. threaded connectors, which are coupled to an electrical power supply source. This will be further described in detail below.

On the surfaces of the fan blades 3 an electrical insulation coating, such as mica, having heat-resistant characteristics, may be provided beforehand. Alternatively, the fan blades 3 may be made entirely of an electrical insulation material having heat-resistant characteristics.

Along the length of the heating element 1 there is at least one breaking gap 20 thereon, and in Fig. 1 there are shown three breaking gaps. Further, at least one means 17 for switching on the heating element 1 when the rotational speed of the fan impeller 2 exceeds a predetermined speed, and for switching off the heating element when the fan impeller 2 drops below the predetermined speed, is connected on the corresponding breaking gap 20.

Referring to Figs. 1, 4, 5, and 6, one preferred embodiment of the switching means 17 includes a stationary connecting element 17a having one end fastened to the heating element 1 at one side 20a of the breaking gap 20, and a resilient connecting element 17b having one end fastened to the heating element 1 at the other side 20b of the breaking gap 20. The resilient connecting element 17b is separated with the stationary connecting element 17a by a small distance. This distance determines the predetermined speed. Both of them are arranged vertical to the direction of the centrifugal force generated due to the rotation of the fan impeller 2, wherein the resilient connecting element 17b is closer to the center of the fan impeller 2 than the stationary connecting element 17a.

Therefore, when the fan impeller 2 rotates at the predetermined speed, its generating centrifugal force is then sufficient to urge the resilient connecting element 17b against the stationary connecting element 17a as shown in Fig. 5. As a result, the length of the heating element 1 is formed in a conductive loop for the electrical power. When the rotational speed of the fan impeller 2 drops below the predetermined speed, the generating centrifugal force is no longer sufficient to urge the resilient connecting element 17b to contact the stationary conenecting element 17a. As a result, the resilience of the resilient connecting element 17b will return it back to the original position, and the length of heating element 1 forms a nonconductive loop. It should be noted that a weight ball 17c may be provided on the place near the free end of the resilient connecting element 17a for increasing the centrifugal force. Also, the switching means 17 may include means 17d for adjusting the distance between the stationary connecting element 17a and the resilient connecting element 17b, mounted adjacently to the resilient connecting element 17b as shown in Fig. 6. By means of the adjusting means 17d, the predetermined speed to turn on the switching means 17 can be easily changed.

Referring to Fig. 7, the other preferred embodiment of the switching means 17 according to the present invention also includes a stationary and a resilient connecting element 171 and 172. However, in this embodiment both of them are arranged vertical to the rotational direction A of the fan impeller 2, and the resilient connecting element 172 is placed in front of the stationary connecting element 173, if viewing from the rotational direction A. Similarly, the switching means 17 will be turned on by the air resilience generated due to the rotation of the fan impeller 2 when the fan impeller 2 rotates up to the predetermined speed, in contrast to the centrifugal force described above, and be turned off when the fan impeller 2 rotates at the speed below the predetermined speed. Further, the structures of the adjusting means 173 and the weight ball 174, and the fastening means of the connecting elements 171 and 172 to the heating element 1 are all the same as those in the first preferred embodiment.

Referring now back to Figs. 1, 2, and 3, the central portion of the fan impeller 2 is a cup connector 4 around the outer circular surface on which the fan blades 3 are secured. The cup connector 4 is engaged to the driving shaft 5a of the driving motor 5 at its rear hollow part 6. The two fastening means 7 and 8, eg. threaded connectors, are electrical conductors, and they respectively fasten the two free ends 9 and 10 of the heating element 1 on the front surface 4a of the cup connector 4 by screwing from the front surface into the rear hollow part 6 of the cup connector 4. A stationary disc 13 made of an electrical insulation material is secured on the casing of the motor 5, and has a central bore 13a for the driving shaft 5a to extend through. On the stationary disc 13 two concentric circular grooves 13b and 13c are provided, and two openings 13d and 13e respectively extend from the bottom of the grooves to the rear surface of the stationary disc 13. The surfaces of the grooves 13b and 13c are all preferably formed in an arched shape. The circular grooves 13b and 13c are separated, and respectively have a metal layer covered thereon. Two power supply lines 14 and 15 are inserted into the openings 13d and 13e and then fastened on the metal layers of the grooves 13b and 13c, respectively.

Two connecting elements 11 and 12 which are electrical conductors respectively have one end connected to the respective fastening means 7 or 8, and the other end slidably abutted against the respective groove 13b or 13c. When the fan impeller 2 rotates, the connecting means 11 and 12 will rotate and slide along the respective grooves 13b and 13c without detachment following the rotation of the fastening means 7 and 8. Therefore, the electrical power can be supplied to the heating element 1 through the metal layers on the grooves 13b and 13c, the connecting elements 11 and 12, and the fastening means 7 and 8, in the event that the switching means 17 is on due to the rotation of the fan impeller 2. Further, the connecting elements 11 and 12 are preferably constructed from resilient plates, e.g. leaf springs, so that they can bias their free ends to firmly contact the grooves 13b and 13c. At the free ends of the connecting elements 11 and 12 there are two abrasive contacts 11a and 12a. The abrasive contacts 11a and 12a are preferably in a ball shape in correspondance to the arched surfaces of the grooves 13b and 13c, and are made of silver.

According to the above-described structure of the heating device of the present invention, the power sources respectively supplied to the driving motor 5 and the heating device are advantageously separated. The electrical power is supplied to the heating element 1 only when the fan impeller 2 rotates at the speed higher than the predetermined speed. It should be noted that the heating element 1 can be alternatively fastened on the housing of the fan and in the air delivery path, and the switching means is arranged on the place where it will rotate with the rotation of the fan impeller to properly perform its function.

CLAIMS

1. A heating device for a fan which has a fan impeller and a driving motor connected to the fan impeller through its driving shaft to drive the fan impeller, comprising:

a length of heating element having a breaking gap thereon mounted on the fan and in the air delivery path of the fan, and adapted to be coupled to an electrical power source; and

means for switching on the heating element when the rotational speed of the fan impeller exceeds a predetermined speed, and switching off the heating element when the fan impeller drops below the predetermined speed, the switching means connected to the breaking gap and secured on the fan impeller for being rotated with the fan impeller.

2. A heating device as claimed in 1, wherein the switching means includes a stationary connecting element having one end fastened to the heating element at one side of the breaking gap, and a resilient connecting element having one end fastened to the heating element at the other side of the breaking gap, separated with the stationary connecting element by a small distance, and adapted to be urged to bend toward and contact the stationary connecting element by a pushing force generated due to the rotation of the fan impeller.

3. A heating device as claimed in claim 2, wherein the stationary and resilient connecting elements are arranged vertical to the direction of the centrifugal force generated due to the rotation of the fan impeller, and wherein the resilient connecting element is closer to the center of the fan impeller than the stationary connecting element.

4. A heating device as claimed in claim 2 or 3, wherein the resilient connecting element is provided with a weight ball thereon near the free end thereof.

5. A heating device as claimed in claim 2, wherein the stationary and resilient connecting elements are arranged vertical to the rotational direction of the fan impeller, and the resilient connecting element is placed in front of the stationary connecting element along the rotational direction for being urged to bend back to contact the stationary connecting element by the air resistance generated due to the rotation of the fan impeller.

6. A heating device as claimed in any one of claims 1 to 5, wherein the length of heating element is serpentined on the front surface of fan blades of the fan impeller, which has been clothed with an electrical insulation material having heat-resistant characteristics.

7. A heating device as claimed in any one of claims 1 to 6, wherein the central portion of the fan impeller is a cup connector which secures the fan blades around the outer circular surface thereof, and is engaged to the driving shaft at its rear hollow part, and wherein the heating device further comprises two fastening means which are electrical conductors for respectively fastening two free ends of the heating element on the front surface of the cup connector; a stationary disc which is an electrical insulator, and has two concentric circular grooves respectively covered with a metal layer thereon, secured on the casing of the motor and coupled to an electrical power source at the metal layer on the circular grooves; and two connecting elements which are electrical conductors, and which respectively have one end connected to the respective fastening means, and the other end slidably abutted against the respective groove, whereby the electrical power is supplied to the heating element through the metal layers, the connecting means, and the fastening means when the switching means is turned on.

8. A heating device as claimed in claim 7, wherein each end abutted against each groove of each connecting element has an abrasive contact thereon.

9. A heating device as claimed in claim 8, wherein each abrasive contact is made of silver.

10. A heating device as claimed in claim 9, wherein each silver abrasive contact is in the form of a ball, and each groove is formed with an arched surface.

11. A heating device as claimed in claim 9 or 10, wherein each connecting element is a resilient plate which biases the silver abrasive contact firmly against the arched surface.

12. A heating device as claimed in any one of claims 7 to 11, wherein the stationary disc has two openings extending from its rear surface to the bottom of the grooves, respectively, for two power supply lines to insert thereinto and then fasten to the metal layers of the grooves, respectively.

13. A heating device as claimed in any one of claims 7 to 12, wherein each fastening means is a threaded connector which has a part extending through the front surface of the cup connector, and connecting to the connecting element.

14. A heating device as claimed in any one of claims 7 to 13, wherein the resilient connecting element includes means for adjusting the distance between the stationary connecting element and the resilient connecting element mounted adjacently to the resilient connecting element in order to preset the predetermined speed.

15. A heating device substantially as hereinbefore described with reference to any one of Figures 1 to 7 of the accompanying drawings.

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